REMARKS

This is in response to the Office Action that was mailed on February 3, 2006. At the top of page 2 of the Office Action, the Examiner suggested that the paragraph bridging pages 2-3 of the Office Action be amended for greater clarity. The present amendment to the specification conforms the language in question to JP 2,984,549. With respect to lines 4-7 on page 3 of the specification, the language "the silicone adhesive layer" is mistranslated. In the priority document, the corresponding relevant language is "The tack strength (or adhesive property) between the die bonding layer and the radiation-polymerizable adhesive layer changes or increases with the passage of time, also preventing the chips from being easily picked up". Claims 1 and 4 are amended to be more specific with respect to their recitations of the silicone adhesive compositions. See e.g. silicone adhesive composition VI in which heat curing is conducted (page 26, lines 22-26). New claim 7 is based upon disclosure on page 25 of the specification (Preparation Example 6). New claims 8 and 9 are based upon disclosure on page 33 of the specification (Table 1). No new matter is introduced by this Amendment. Claims 1-9 are pending in the application.

Claims 1-6 were rejected under the first paragraph of 35 USC § 112. The Examiner requested that the claims be amended to recite make it clear that the layers recited in claim 1 actually contact one another. The present Amendment amends claim 1 in accordance with the Examiner's request.

Claims 1-6 are rejected under 35 USC § 103(a) as being obvious from US 6,007,920 (Umehara). Claims 1-6 are also rejected as being obvious from the combination of the Umehara reference with JP 2002-256236 (Hitachi). The Examiner explains the basis for these prior art rejections on pages 3-4 of the Office Action. The Examiner believes that Umehara discloses combinations that are very similar to combinations embraced by claims 1-6. The Examiner takes the position that the tack strength limitation recited in Applicants' claim 1 would be inherent in the Umehara compositions. The rejections are respectfully traversed, for the following reasons.

As described in the present specification, in the manufacture of semiconductor devices, a large diameter silicon wafer is secured by an adhesion tape (known as dicing tape) and subjected to a dicing (sawing and separating) step where the wafer is divided into semiconductor chips. The chips are then peeled from the dicing tape. Each chip is picked up and secured to a lead frame with a curable liquid adhesive (or die bonding agent) through heat compression bonding. A process capable of carrying out dicing and die bonding steps continuously is desirable. Contamination of semiconductor parts with fluid ingredients from the liquid adhesive and the squeeze-out of the adhesive from chip securing sites are also issues of concern. It is accordingly desired to have a dicing/die bonding tape in the form of an adhesion sheet having an adhesive layer of non-liquid adhesive and possessing both the wafer-securing function of dicing tape and the bonding function of die bonding agent. The dicing/die bonding tape needs to develop a tack force (or attachment) strong enough to prevent chips as diced from being moved or released during the dicing step, to adhere to the chip being taken away in the pickup step, and to develop a strong bond to the lead frame in the subsequent die bonding step.

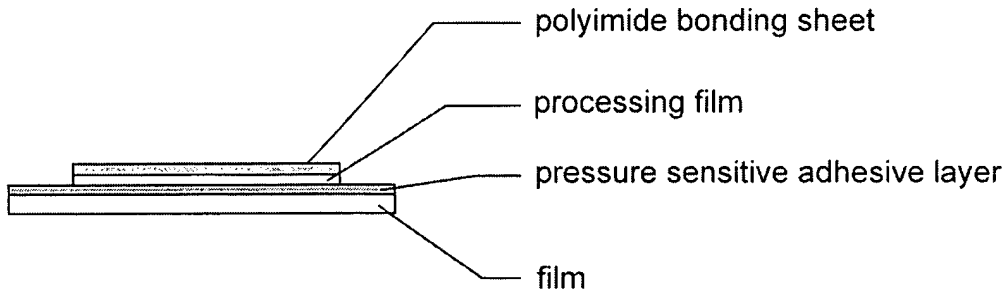
The present invention provides such a dicing/die bonding tape. The dicing/die bonding tape of this invention is capable of holding a wafer at a level to withstand dicing and stabilizing the tack strength (or adhesive property) to the die bonding layer so as to allow for easy pickup of chips, and also has improved adhesion to lead frames.

This is accomplished by using a curable polyimide/epoxy resin composition having improved adhesion as a die bonding layer that can be bonded to a wafer by heat compression, and interposing a silicone adhesive layer, which is incompatible with the die bonding layer, between the die bonding layer and the substrate. This approach provides a dicing/die bonding adhesion tape in which the tack strength between layers is controllable, and the heat fusion and tack strength change little with time. In this way, the dicing/die bonding adhesion tape of the present invention ensures consistent dicing and chip pickup operations and improved adhesion for die bonding.

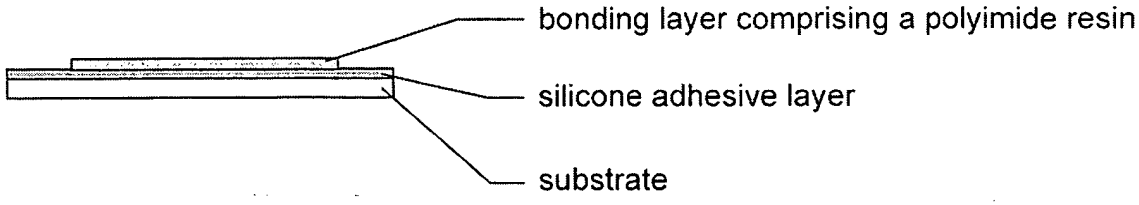
The dicing/die bonding adhesion tape of the invention has several advantages: for instance, (1.) when a wafer is bonded to the bonding layer of the tape by heat compression, the wafer is secured at a sufficient level to withstand dicing; (2.) after dicing, chips having the bonding layer attached thereto can be smoothly picked up; and (3.) the tack strength (or bonding force) between the adhesive layer and the die bonding layer remains constant. The chips having the bonding layer attached thereto can then be firmly bonded to lead frames by joining them together through heat compression and heat curing. The present invention insures consistent and improved dicing, chip pick up, and die bonding.

The Umehara reference discloses a wafer dicing/bonding sheet, comprising: a sheet for expanding process comprising a film having formed thereon a pressure sensitive adhesive layer; and a polyimide bonding sheet comprising a processing film having formed thereon a polyimide adhesive layer, with the processing film attached to the pressure sensitive adhesive layer.

Accordingly, the wafer dicing/bonding sheet of Umehara has the following construction:



In contrast, the tape of the present invention has the following construction:



Manifestly, the construction of the tape of this invention differs significantly from the construction of the Umehara tape (sheet).

Moreover, Umehara fails to teach or suggest the use of a silicone adhesive layer formed of a silicone adhesive composition comprising a heat curable chain-like (or linear) organopolysiloxane and a solid silicone resin by heat curing in accordance with the present invention.

JP 2002-256236 discloses a bonding sheet comprising a radiation polymerizable substrate and a bonding layer containing polyimide resin (A), epoxy resin (B), phenolic resin (C), and a curing accelerator. The radiation polymerizable substrate contains as a radiation curable substrate a compound having at least one carbon-carbon double bond therein or a substrate having a functional group having at least one carbon-carbon double bond attached. Thus, JP 2002-256236 also fails to disclose and teach the use of the inventive silicone adhesive layer formed by heat curing a silicone adhesive composition comprising a heat curable chain-like organopolysiloxane and a solid silicone resin.

As is disclosed in the present specification, this die bonding layer formed by heat curing the curable epoxy resin composition is improved in adhesion in moist conditions, and adhesion at elevated temperature and strength. However, sometimes the chips as diced are hindered from being picked up. More particularly, the radiation-polymerizable adhesive layer which controls adhesion between the substrate and the die bonding layer as reported in Japanese Patent No. 2,984,549 is formed of a composition comprising a (meth)acrylate copolymer, (meth)acrylic radical-containing polymer, or polyfunctional acrylic compound and a photo-polymerization initiator. This composition is compatible with the die bonding layer. On account of reaction due to UV exposure or fusion between the adhesive and the die bonding layer which is softened by heat compression for wafer holding in the dicing step, the tack strength is increased to prevent the chips from being easily picked up. The tack strength (or adhesive property) between the die

bonding layer and the radiation-polymerizable adhesive layer increases with the passage of time, also preventing the chips from being easily picked up.

It is clear from the above discussion that the presently claimed invention is not suggested by the combination of Umehara and JP 2002-256236. Withdrawal of the rejection of record is earnestly solicited.

If there are any questions, the Examiner is requested to contact Richard Gallagher, Registration No. 28,781, at (703) 205-8008.

Dated: May 3, 2006

Respectfully submitted,

By _____ #28,781
Gerald M. Murphy, Jr.
Registration No.: 28,977
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road
Suite 100 East
P.O. Box 747
Falls Church, Virginia 22040-0747
(703) 205-8000
Attorney for Applicant